REMARKS

Claims 1, 4, 7-13, and 16-21 are pending in the above-identified application. Claim 1 is amended by deleting the product-by-process limitation. Support for new claim 21 can be found in the present specification, *inter alia*, at page 25, lines 4-24. Thus, no new matter has been added. Based upon the above considerations, entry of the present amendment is respectfully requested. In view of the following remarks, Applicants respectfully request that the Examiner withdraw all rejections and allow the currently pending claims.

Issues under 35 U.S.C. § 103(a)

1) Claims 1, 4, and 7-8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Freedman '782 (US 5,186,782) in view of Argoitia et al. '936 (US 6,749,936).

2) Claims 9-13 and 16-20 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Freedman '782 in view of Argoitia et al. '936 and further in view of Bergholts et al. '245 (WO 99/61245).

Applicants respectfully traverse, and reconsideration and withdrawal of these rejections are respectfully requested.

Legal Standard for Determining Prima Facie Obviousness

MPEP 2141 sets forth the guidelines in determining obviousness. First, the Examiner has to take into account the factual inquiries set forth in *Graham v. John Deere*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), which has provided the controlling framework for an obviousness analysis. The four *Graham* factors are:

(a) determining the scope and content of the prior art;

(b) ascertaining the differences between the prior art and the claims in issue;

(c) resolving the level of ordinary skill in the pertinent art; and

(d) evaluating any evidence of secondary considerations.

Graham v. John Deere, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966).

Second, the Examiner has to provide some rationale for determining obviousness. MPEP 2143 sets forth some rationales that were established in the recent decision of *KSR International Co. v Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007).

As the MPEP directs, all claim limitations must be considered in view of the cited prior art in order to establish a *prima facie* case of obviousness. *See* MPEP 2143.03.

The Present Invention

An object of the present invention is to provide a labeled container that can prevent discoloration and deterioration caused by light, can be printed clearly with a design, and yields an excellent appearance of its contents when viewed from outside (page 2, line 23 to page 3, line 4). Another object of the present invention is to provide a heat-shrinkable opaque white film and a shrink label which are useful for preparing the labeled container (page 3, lines 4-6).

As amended, independent claim 1 recites:

> A heat-shrinkable opaque white film comprising a core layer; and white back and front layers,
>
> wherein the core layer comprises at least one colorant selected from the group consisting of black pigments, yellow pigments, red pigments, and brown pigments, and has a chromatic color with low transparency to light at wavelengths of 380 to 500 nm or an achromatic color,
>
> wherein each of the white front layer and the white back layer independently comprises a white colorant, and the content of the white colorant in each of the front layer and the back layer is 1 to 20 percent by volume of the total volume of each layer,
>
> wherein each of the front layer, the core layer, and the back layer independently is a heat-shrinkable film layer;
>
> wherein the film has a transmission factor to light at wavelengths of 380 to 500 nm of 5% or less;
>
> wherein the heat-shrinkage percentage of the film is about 20% to about 90% when the film is immersed in hot water at 90°C for ten seconds; and
>
> wherein the W-value of the surface of the heat-shrinkable films is 75 or more.

As another embodiment of the present invention, claim 9 recites:

> The heat-shrinkable opaque white film according to Claim 1, wherein the core layer comprises a black colorant, and the content of the black colorant is $1x10^{-3}$ to 6 percent by volume based on the total volume of the core layer.

As yet another embodiment of the present invention, claim 12 recites:

> The heat-shrinkable opaque white film according to Claim 1, wherein the core layer comprises at least one chromatic colorant selected from yellow pigments, red pigments, and brown pigments, and the content of the chromatic

colorant is 0.01 to 20 percent by weight based on the total weight of the core layer.

As shown in claims 7 and 8, examples of distinguishing features of the present invention are:

> 7. A shrink label comprising the heat-shrinkable opaque white film of Claim 1; and a preprinted ink label layer arranged on or above a surface of the front layer of the film.
>
> 8. A labeled container comprising a container body; and the shrink label of Claim 7 arranged on or above the container body.

The heat-shrinkable opaque white film according to the present invention prevents discoloration and deterioration of a container's contents, such as beverages, and enables clear printing of a design on a front layer (page 47, line 5 to page 48, line 3). In addition, the shrink label using the heat-shrinkable opaque white film according to the present invention is very useful as a label that gives an excellent impression of the contents, such as beverages, when applied to a container (page 48, lines 3-7).

As shown in claim 21, another example of distinguishing features of the present invention is:

> 21. The labeled container according to Claim 8, wherein the shrink label is arranged on or above the container body without adhesive.

The heat-shrinkable opaque white film having the layer configuration, i.e., white heat-shrinkable film layer (front layer)/black, grey or chromatic heat-shrinkable film layer (core layer)/white heat-shrinkable film layer (back layer), can be prepared by subjecting a resin composition (A) containing a resin and a white colorant, a resin composition (B) containing a resin and at least a black colorant or a chromatic colorant, and a resin composition (C) containing a resin and a white colorant to melt-coextrusion using an extruder equipped with a T-die or annular die, cooling the extrudate typically using a chill roll, and drawing the cooled extrudate (page 19, line 11 to page 20, line 1).

Distinctions over the Cited References

In contrast, Freedman '782 relates to a method for high-speed labeling of deformable substrates, such as squeeze bottles and the like, and to the manufacture of film facestocks usable with the method. The method comprises the step of extruding in film form a charge of polymeric material for label stock. However, the film is not a heat-shrinkable film. In addition, the film does not contain a black colorant, a red pigment, a yellow pigment, or a brown pigment in the core layer (see claims). Moreover, although the film has a front layer, a core layer, and a back layer, each of the layers is not independently a heat-shrinkable film layer. Furthermore, there is no description of a transmission factor to light, a heat-shrinkage percentage, or W-value of the film. In this regard, Applicants submit that the Examiner appears to confuse the light imperviousness of the present invention with opacity of Freedman '782. The present invention relates to opacity and a light imperviousness property and is different in this respect from the cited reference. Therefore, Freedman '782 is definitively different from the present invention.

Argoitia et al. '936 disclose achromatic multilayer pigments used in ink, paint, or moldable plastic material with resins such as styrenes (col. 21, lines 1-30) and combined with pigments (chromatic) TiO_2 to produce unique color effects and with carbon black, blue, or aluminum to control lightness and other color properties. The pigment flakes of Argoitia et al. '936 can be used as inks for printing on packaging and containers or can be used to form colored plastic materials, extruded parts, and laminating films (col. 21, line 50 to col. 22, line 36).

Argoitia et al. '936 relate to a technology that changes the color of the surface to impart to the packaging material a desired appearance. In contrast, in the film according to the present invention, a core layer contains a black colorant, a red pigment, a yellow pigment, or a brown pigment in order to impart a light imperviousness property rather than to give color variation to the film. The core layer cannot be seen from outside. Therefore, Argoitia et al. '936 do not disclose the film of the present invention because one of ordinary skill in the art would not add the pigments into the "invisible layer" of Argoitia et al. '936. Furthermore, Argoitia et al. '936 do not disclose that the film has a transmission factor to light at wavelengths of 380 to 500 nm of 5% or less. Thus, the present invention and Argoitia et al. '936 are quite different technologies and the effect of the light imperviousness of the present invention cannot be derived from the disclosure of Argoitia et al. '936.

Bergholts et al. '245 relate to a packaging material including layers of plastic permanently united with one another and of which at least one layer includes, for the purpose of elevating light-barrier properties, distributed particles of carbon black. Specifically, the reference discloses market bottles which are produced by a combined extrusion/blow molding operation of a triple-layer material, which consists of an interjacent layer having light-absorbing carbon black particles and two outer layers having white pigment titanium dioxide (TiO_2). While the film of the present invention is the film consisting of three layers which are all heat-shrinkable films, the film of the cited reference contains only a partial heat-shrinkable property. The film of the present invention has the prominent effect over the film of the cited reference, such as no occurrence of ink cracking. Therefore, the present invention involves an inventive step to the cited reference.

Furthermore, the present invention and the cited references differ with respect to (1) heat shrinkability, (2) the light imperviousness property, and (3) the constituent components.

1. Presence of Heat-Shrinkability

Applicants have enclosed herewith a website article labeled "Attached material 1." The article is a copy of the item "film" from the Japanese version of Wikipedia. The definitions of "drawing," "shrink film," and "thermal fixation" are explained. The English translation of the article is also attached and provided below:

> Drawing
> Process for pulling film to direction of uniaxis or two axial directions, using a character of plastic molecules that when pulling in constant direction while some heating the molecule lines up in the direction of the transformation, and strength increases. In addition, the improvement of chemical resistance and the transparency of the molecules can be expected. The character appears remarkably especially in the polyester, polypropylene, nylon and the like. The films subjected to this stretching process is thick molded in the first manufacturing process, in consideration of becoming thinner after the drawing process.
>
> The drawn film shrinks when the calorie is provided that exceeds the temperature at which the drawing process was conducted. "Shrink film" is a film loosely wrapped on a material such as a bottle to be wrapped, and then shrinks and fixes the material when heat is applied due to this heat-shrinking character. On the other hand, one drawn under the high temperature takes an excellent character in heat dimensional stability. This is called heat-set.

The technology described in Freedman '782 includes "extruding in film form a charge of polymeric material for label stock, hot-stretching and heat-setting said extruded film." The heat-setting corresponds to the "heat-set" described above. Since the procedure of Freedman '782 is different from a typical heat-shrinkable film, the heat-shrinkable film of the present invention cannot be produced through the procedure of Freedman '782.

Applicants have also enclosed herewith relevant portions of a textbook and its translation labeled "Attached material 2." The attached textbook is widely used for the education of those skilled in the art in Japan. In the text, the outline of the mechanism of the drawing (page 50) and the character to be imparted to the character of the film by the drawing are described in detail. Specifically, the textbook states, "To suppress the heat-shrinkability of the film after the drawing, the heat-set is done" (page 50, line 4). Furthermore, the textbook states, "Although plastic expands when the temperature rises, if the temperature further rises, the drawn film shrinks. This mechanism of shrinkage is as follows. The molecule is arranged in the direction of the drawing and heat-set acts to fix the arranged state. When a temperature that is higher than the temperature condition by this heat condition is applied, the arranged state collapses, and shrinkage happens as a movement to remove the distortion caused by the drawing. Such a shrinkage behavior is not seen in a no drawing film" (page 66, last line to page 67, line 5).

In other words, when a film is subjected to a higher temperature (heat-set), the film no longer shrinks. Thus, one of ordinary skill in the art would know that the feature of the heat shrinkability with no heat-set is characteristic of the drawn films as described above as confirmed again by attached material 2. Therefore, the film described in Freedman '782 is not a heat-shrinkable film because the film is subjected to heat-set.

Moreover, enclosed herewith is a 37 CFR § 1.132 Declaration of Shinji Banno. The Examiner is respectfully requested to review the enclosed Declaration of Shinji Banno as it provides strong evidence of the patentability of the present invention. Specifically, as described in Experiment 1, drawn films were made according to the method of the description in Example 1 of the present specification, and then, the heat-set was applied to the films to produce the films of Experiment 1. These films were subjected to the heat shrinkage test.

As shown in the table of the Declaration, Film B of Experiment 1 did not show any heat shrinkage when treated under the condition of 150°C for one minute. On the other hand, Film A, the film of the positive control (no heat-set), showed a heat contraction of 54% by similar processing. Thus, the heat shrinkage did not occur from the result of Experiment 1 on the heat-set films. Therefore, the film described in Freedman '782 is not a heat shrinkable film.

In addition, as discussed above, claim 1 recites, *inter alia*, "A ***heat-shrinkable opaque white film*** comprising a core layer; and white back and front layers" (emphasis added). None of the cited references disclose a "heat-shrinkable opaque white film." The film described in Freedman '782 is subject to heat-set so that it is stretched, but it does not become heat-shrinkable. Thus, the film is not a heat-shrinkable film.

On page 5 of the outstanding Office Action, the Examiner asserts that Bergholts et al. '245 is a "similar shrinkable" material. However, Bergholts et al. '245 do not disclose a heat-shrinkable opaque white film either.

Furthermore, claim 1 also recites that "the heat-shrinkage percentage of the film is about 20% to about 90% when the film is immersed in hot water at 90°C for ten seconds" and that "each of the front layer, the core layer, and the back layer independently is a heat-shrinkable film layer." Since the cited references fail to disclose a heat-shrinkable film, they contain no description regarding the heat-shrinkage percentage of the film.

Heat-shrinkable film, as used in the present invention, is known to one of ordinary skill in the art as a film that is loosely wrapped around a material, such as a bottle, and is then shrunk and fixed to the material when heat is applied due to its heat-shrinking character. In contrast, one of ordinary skill in the art would also understand that the term "heat-set" relates to a completely different process.

The technology described in Freedman '782 includes "extruding in film form a charge of polymeric material for label stock, hot-stretching and heat-setting said extruded film" (claim 1). The heat-setting corresponds to the "heat-set" described above. Since the procedure of Freedman '782 is different from typical heat-shrinkable film, the heat-shrinkable film of the present invention cannot be produced through the procedure of Freedman '782.

In addition, Freedman '782 specifically discloses:

> The heat-set labels contemplated by the methods of the present invention and the die-cut label applications to which the present invention relates are to be contrasted with shrink-films, consisting of stretched, unannealed films, sometimes

> used in sleeve-labeling applications wherein a sleeve or wrap of shrink film is placed around the circumference of a bottle or can or like container and heated to cause it to shrink into tight, surrounding engagement with the container. Examples of the latter are found in U.S. Pat. Nos. 4,581,262 and 4,585,679. The tendency to shrink causes such film to tend to withdraw from any borders, tending to leave exposed adhesive, a particular disadvantage in die-cut label applications since exposed adhesive is unsightly and tends to catch dust. (col. 1, line 56 to col. 2, line 2).

Similarly, Freedman '782 also recites:

> To the extent that elimination of hot-stretching also eliminates or minimizes the need to anneal or heat-set the film, such step may be eliminated so long as the resulting film exhibits the characteristics of a heat-set or annealed film, i.e. is essentially devoid of "memory" of a pre-existing configuration to which a film tends to return under the influence of heat. The heat set differentially stiffened films of the present invention differ in this respect from "shrink" films of the prior art (col. 11, lines 10-19).

Thus, Freedman '782 fails to disclose a heat-shrinkable opaque white film of the present invention. The other cited references do not overcome this deficiency. In fact, Freedman '782 actually teaches away from using a heat-shrinkable film.

More specifically, Freedman '782 does not disclose a heat-shrinkable opaque white film wherein the core layer comprises at least one chromatic colorant selected from yellow pigments, red pigments, and brown pigments, and the content of the chromatic colorant is 0.01 to 20 percent by weight based on the total weight of the core layer. In addition, even if the disclosure of Freedman '782 is combined with the other cited references, this feature of the present invention cannot be accomplished.

One of the features of the present invention is a heat-shrinkable opaque white film having white back and front layers and a core layer with at least one chromatic colorant selected from yellow pigments, red pigments, and brown pigments. This feature is not described in the cited prior art. A usual film (for instance, one having an ink layer in either the surface layer, the center layer, or the back layer) cannot keep the constant shading and opalescent appearance due to the different shrinkage properties between the layers. Under some specific situations, there is also a possibility that cracking and the like occur. The film of the present invention is able to heat-shrink, remains impervious to light, and does not adversely affect the white appearance of the film according to the composition as recited in claim 1.

2. The Light Imperviousness Property of the Film of the Present Invention

The light imperviousness effect is not achieved in the film of Freedman '782. As described in Experiment 2 of the enclosed Declaration, the heat shrinkable film was made according to the method of Example 1 of the present specification, with the exception of not using carbon black. The film of Experiment 2 has a structure of white/white/white layers because carbon black was not used. This structure is a similar structure to that of the film described in Freedman '782. When light was irradiated from one side of the film mounted on a PET bottle, the light penetrated inside the PET bottle as shown in the figure of the enclosed Declaration. Thus, the effect of the light imperviousness property was not achieved in this structure (the film described in Freedman '782).

3. Comparison of Constituent Components

The table below shows the differences in construction, objects, and effects between the present invention and the cited references.

	Present Invention	**Cited References**
construction	claim 1 (heat-shrinkable opaque white film)	
	(a) A heat-shrinkable opaque white film comprising a core layer; and white back and front layers,	(a)' None of the cited references disclose the heat-shrinkable opaque white film. Since the film described in Freedman is subject to heat-set so that it is stretched but not become heat-shrinkable, this film is not a heat-shrinkable film. Belgholts does not disclose the heat-shrinkable opaque white film, either. Only the multilayer film is disclosed including a core layer, a skin layer on the face side of the coextrudate, and a skin layer on the inner side of the coextrudate opposite the face side (Freedman, column 5, lines 21-27, Fig, 3).
	(b) wherein the core layer comprises at least one colorant selected from black pigments, yellow pigments, red pigments, and brown pigments, and has a chromatic color with low transparency to light at wavelengths of 380 to 500 nm or an achromatic color,	(b)' Freedman disclose no colorant. Belgholts disclose the black colorant but not chromatic colorant. "the pigment flake has a diffractive structure thereon, the pigment flake having an average background reflectivity in diffuse lighting conditions of less than about 30% at a spectral wavelength range from about 400 nm to about 700 nm" (Argoitia, claim 39).

	Present Invention	**Cited References**
	(c) each of the white front layer and the white back layer independently comprises a white colorant, and the content of the white colorant in each of the front layer and the back layer is 1 to 20 percent by volume of the total volume of each layer,	(c)'. Suitable quantities of white pigment may vary up to approx. 5% of the total weight of the outer layer and of the interjacent layer, respectively, depending upon the pertinent quantity of carbon black in the interjacent layer (Belgholts, page 7, lines 16-19).
	(d) wherein each of the front layer, the core layer, and the back layer independently is a heat-shrinkable film layer,	(d)' None of the cited references disclose the heat-shrinkable opaque white film in which each of the front layer, the core layer, and the back layer independently is a heat-shrinkable film layer.
	(e) the film has a transmission factor to light at wavelengths of 380 to 500 nm of 5% or less,	(e)' "the pigment flake has a diffractive structure thereon, the pigment flake having an average background reflectivity in diffuse lighting conditions of less than about 30% at a spectral wavelength range from about 400 nm to about 700 nm" (Argoitia, claim 39).
	(f) the heat-shrinkage percentage of the film is generally about 20% to about 90% when the film is immersed in hot water at 90°C for ten seconds, and	(f)' Since the cited references disclose no heat-shrinkable film, there are no description about the heat-shrinkage percentage of the film.
	(g) W-value of surface of the heat-shrinkable films is the W-value of 75 or more.	(g)' The film described in Freedman is subject to heat-set but it is not a heat-shrinkable film. W-value is described in no cited references.
	claim 9 (heat-shrinkable opaque white film comprising a black colorant) (h) wherein the core layer comprises a black colorant, and the content of the black colorant is $1x10^{-3}$ to 6 percent by volume based on the total volume of the core layer.	(h)' "The quantity of carbon black in the interjacent layer 11 lies generally within the range of 0.04-1% of the total weight of the interjacent layer" (Belgholts, page 6, lines 24-25).
	claim 12 (heat-shrinkable opaque white film comprising at least one chromatic colorant) (i) wherein the core layer comprises at least one chromatic colorant selected from yellow pigments, red pigments, and brown pigments, and the content of the chromatic colorant is 0.01 to 20 percent by weight based on the total weight of the core layer.	(i)' None of the cited references disclose that the core layer comprises at least one chromatic colorant selected from yellow pigments, red pigments, and brown pigments, and the content of the chromatic colorant is 0.01 to 20 percent by weight based on the total weight of the core layer.

	Present Invention	**Cited References**
	claim 7 (j) A shrink label comprising the heat-shrinkable opaque white film of Claim 1; and a preprinted ink label layer arranged on or above a surface of the front layer of the film.	(j)' Since the cited references disclose no heat-shrinkable film, there are no description about a shrink label comprising the heat-shrinkable opaque white film.
	claim 8 (k) A labeled container comprising a container body; and the shrink label of Claim 11 arranged on or above the container body.	(k)' Since the cited references disclose no heat-shrinkable film, there are no description about a labeled container comprising shrink label comprising the heat-shrinkable opaque white film.
object	"an object of the present invention is to provide a labeled container that can prevent its contents from discoloration and deterioration caused by light, can be printed clearly typically with a design, and yields an excellent appearance of the contents when viewed from outside. Another object of the present invention is to provide a heat-shrinkable opaque white film and a shrink label which are useful for preparing the labeled container." (page 2, line 23 to page 3, line 6)	(Freedman) "This invention relates to a method for high-speed labeling of deformable substrates such as squeeze bottles and the like, and to the manufacture of film facestocks usable in the method." (column 1, lines 5-8) (Argoitia) "the diffractive pigment flakes and foils can be fabricated to have specific diffractive surface microstructures along with physical and micro-mechanical attributes that provide enhanced optical effects". (column 1, lines 5-8) (Bergholts) to provide a packaging material of the type described by way of introduction which neither requires large quantities of carbon black to achieve superior light barrier properties nor large quantities of white pigment (Ti02) or other white colouring matter in order to impart to the packaging material a white appearance (page 2, lines 30-35).

	Present Invention	**Cited References**
effect	"the heat-shrinkable opaque white film according to the present invention prevents discoloration and deterioration of contents such as beverages and enables clear printing typically of a design on a front layer. In addition, the shrink label using the heat-shrinkable opaque white film according to the present invention is very useful as a label that gives an excellent impression of the contents such as beverages when applied to a container and achieves good looking of the contents with original color without discomfort " (page 47, line 5 to page 48, line 8)."	(Freedman) "The present invention opens the way to substantial cost savings in the manufacture of polymeric-film facestocks while at the same time maintaining the desirable characteristics of the film facestocks which have been used prior to this invention." (column 2, lines 5-9) (Argoitia) One of the benefits of the present invention is the ability to achieve the full range of color characteristics of diffractive gratings for decorative purposes while at the same time avoiding a silvery or bright metallic appearance under other viewing or illumination conditions. The present invention also achieves the aforementioned aesthetic benefits in illumination conditions that include both collimated and diffuse lighting. (column 7, line 9-16). (Bergholts) " the present invention, with but very simple means, attains its object, at the same time as making possible the production of a packaging material and packages, respectively, with lower material consumption and therefore lower material costs than those involved in the prior art technology."(page 6, lines 1-5).

As shown above, the present invention is different from the cited reference in that the latter does not include, at least, the description corresponding the elements (a), (d), (e), and (g).

To establish a *prima facie* case of obviousness of a claimed invention, all of the claim limitations must be disclosed by the cited references. As discussed above, Freedman '782 in view of Argoitia et al. '936, with or without Bergholts et al. '245, fail to disclose all of the claim limitations of independent claim 1, and those claims dependent thereon. Accordingly, the combination of references does not render the present invention obvious.

Furthermore, the cited references or the knowledge in the art provide no reason or rationale that would allow one of ordinary skill in the art to arrive at the present invention as claimed. Therefore, a *prima facie* case of obviousness has not been established, and withdrawal of the outstanding rejection is respectfully requested. Any contentions of the USPTO to the contrary must be reconsidered at present.

CONCLUSION

A full and complete response has been made to all issues as cited in the Office Action. Applicants respectfully request that a timely Notice of Allowance issue for the present case clearly indicating that each of claims 1, 4, 7-13, and 16-21 are allowed and patentable under the provisions of title 35 of the United States Code.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Chad M. Rink (Reg. No. 58,258) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Dated: SEP 30 2009

Respectfully submitted,

By #47,374

Marc S. Weiner
Registration No.: 32,181
BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road, Suite 100 East
P.O. Box 747
Falls Church, Virginia 22040-0747
(703) 205-8000
Attorney for Applicants

Attachments: Attached material 1
Attached material 2
37 CFR § 1.132 Declaration of Shinji Banno

(A) 練を要求され、条件設定が難しく精度の調整は難しい。

延伸

合成樹脂の、ある程度の加熱をしながら一定方向に引き揃えると分子が変形方向に並び強度が増す性質を利用して、フィルムを一軸方向または二軸方向に引っ張る加工。更に耐薬品性や透明性の向上も図れる。ポリエステル・ポリプロピレン・ナイロンなどで特にその性質が顕著にあらわれる。この延伸加工を施すフィルムは、引き伸ばし後に薄くなることを計算して一次製造時に厚く成型する。

延伸する際にかけた温度を超える熱量がかかると、延伸フィルムは収縮する。この特性を利用し、緩やかに巻きつけたフィルムに熱を加えて縮ませ、梱包物を固定させるものは「**シュリンクフィルム**」と呼ばれる。一方、高熱下で延伸したものは熱寸法安定性に優れる性質を帯びる。これを熱固定と言う。

多層加工法

近年、求められる機能が高度化するに伴い、フィルムは複数の層を重ねた形状に加工される場合が多くなっている。それらを接合・積層させる方法は多様にあり、素材それぞれの溶融温度や相溶性または厚みの構成や製造費用など、様々な要素が考慮されつつ選択される。

共押出法(co-extrusion)

溶融押出成型法において、複数の素材を一度に押し出して重ねる手法。基本的に、積層させる材料の種類と同じ数の押出機を使用する。異なる素材同士を合わせる位置関係によって、その製造法はさらに区分される。

インフレーション法による共押出

異なる樹脂を合わせる位置により3種類に分類される。各溶融樹脂を金型手前のフィードブロック内で接触させるダイ前積層法、金型内部の経路で接触させるダイ内積層法、同心円状の複数リップから吐出し接触させるダイ外積層法がある。

比較的簡便な設備で共押出しが可能だが、樹脂の種類が限定されてしまい、層間接着性に劣る組み合わせには使用できない。

Tダイ法による共押出

異なる樹脂を合わせる位置により2種類に分類される。

シングルマニホールド法は、ダイの直前にフィードブロックを設置し、そこにアダプターを介して複数の押出機を接続する。フィードブロック内で樹脂接触させてからダイを通してフィルムを成型する。層の数はアダプターを交換することで設定でき、比較的簡単に多層のフィルムを得られる。しかしながら、溶融温度や粘度が大きく異なる材料を同時に使用できない欠点がある。

マルチマニホールド法は、内部に複数のマニホールドを持つTダイを使用し、複数の押出機から供給された樹脂をリップ部の直前で接触させ積層する。粘

Partial translation of Attached material 1

Film - Wikipedia

(A)

Drawing

Process for pulling film to direction of uniaxis or two axial directions, using a character of plastic molecules that when pulling in constant direction while some heating the molecule lines up in the direction of the transformation, and strength increases. In addition, the improvement of chemical resistance and the transparency of the molecules can be expected. The character appears remarkably especially in the polyester, polypropylene, nylon and the like. The films subjected to this stretching process is thick molded in the first manufacturing process, in consideration of becoming thinner after the drawing process.

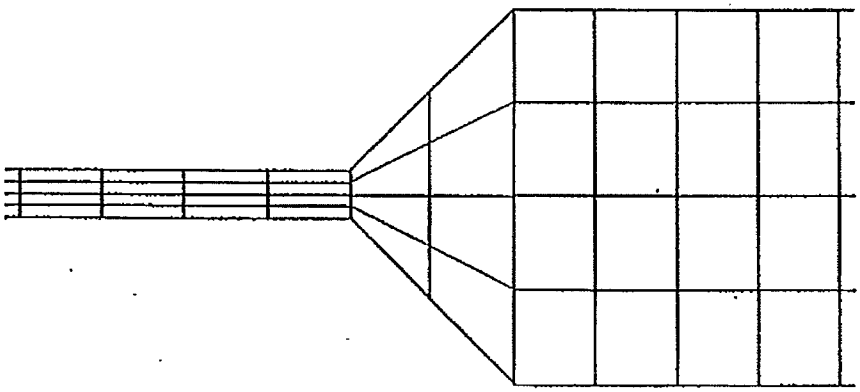
The drawn film shrinks when the calorie is provided that exceeds the temperature at which the drawing process was conducted. "Shrink film" is a film loosely wrapped on a material such as a bottle to be wrapped, and then shrinks and fixes the material when heat is applied due to this heat-shrinking character. On the other hand, one drawn under the high temperature takes an excellent character in heat dimensional stability. This is called heat-set.

Attached material 2

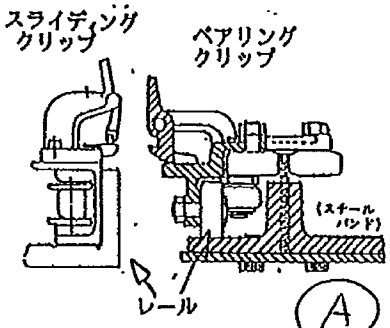
包装用フィルム概論

PPS
EDUCATION
SYSTEM

株式会社　東洋紡パッケージング・プラン・サービス
TOYOBO PACKAGING PLANNING SERVICES, INC.



フィルムの延伸パターン
(縦4倍×横8倍)



予熱部では左右のレールが平行に走っており延伸はされないが、延伸部では左右のレールが広がり、その広がりのパターンによって延伸倍率がきまる。

延伸倍率＝
延伸部の最大フィルム幅／テンター入口のフィルム幅

延伸後、フィルムの熱収縮率をおさえるために熱セット(熱固定)が行なわれる。

⑤同時二軸延伸フィルム

同時二軸延伸は縦方向と横方向を同時に延伸することである。

同時二軸延伸は同時に二軸延伸しなければならないNY－6、PVAやEVOHに使用されている。

なぜ同時に延伸しなければならないかというと、縦方向に延伸したらその時点で結晶化が進みすぎて次の横延伸ができなくなるからである。しかし、多くの改良がなされ、NY－6やPVAも逐次二軸延伸できるようになっている。

各種ポリマーの二軸延伸性

ポリマー	同時二軸	逐次二軸
LDPE	○	×
HDPE	○	×
EVA	○	△
PP	○	○
NY－6	○	×
PET	○	○
PVDC	○	△
PS	○	○
PVA	○	×
EVOH	○	×

同時二軸延伸は押出機、キャスティング、同時二軸延伸、トリミング、コロナ処理及び巻取の工程になる。

同時二軸延伸の工程のみが、逐次二軸延伸と違うのみなので、同時二軸延伸機構について説明する。

3. 熱的性質

(1) 融点とガラス転移点

各種フィルムの融点とガラス転移点を下表に示す。融点は同じ素材でも、メーカー間で若干違うことがある。又、親水性のＯＮＹやＥＶＯＨは吸湿の状況によってガラス転移点は大きく変わる。

なお、ガラス転移点については、Ⅰ．プラスチックの性質で説明したので、ここでの説明は省略する。

	ガラス転移点 (℃)	融　点 (℃)
LDPE	−30, −45	115
LLDPE	−	120～130
PP	−10, −18	163
PET	67～81	264
PA (ナイロン−6)	50	225
MXD−6	64	243
PS	100, 105	140
PVDC	−17	198
EVOH (Et33%)	69	183
PC	150	225
PVA	85	220～240
PS	90	230

(2) 耐熱、耐寒温度

フィルムで食品を包装した場合、包装材料として機能をはたす最高温度と最低温度が、耐熱、耐寒温度（使用可能温度）である。

各フィルムの使用可能な温度範囲

フィルム	融点(℃)	使用可能温度(℃)	備　考
OPP	165	-50～120	
PET	264	-70～150	たいてい表素材
ONY	215～225	-60～140	レトルト用途で表素材として使う時は 120℃以下の条件で使用
CPP	135～165	0～120	レトルト用 130℃
LDPE	105～115	-50～100	
LLDPE	125～130	-20～115	
HDPE	135～150	-50～120	

水があって熱がかかる場合は分解する。

レトルト用というのはCPPしかない

(3) 熱収縮率 (ＪＩＳ　Ｃ2318)

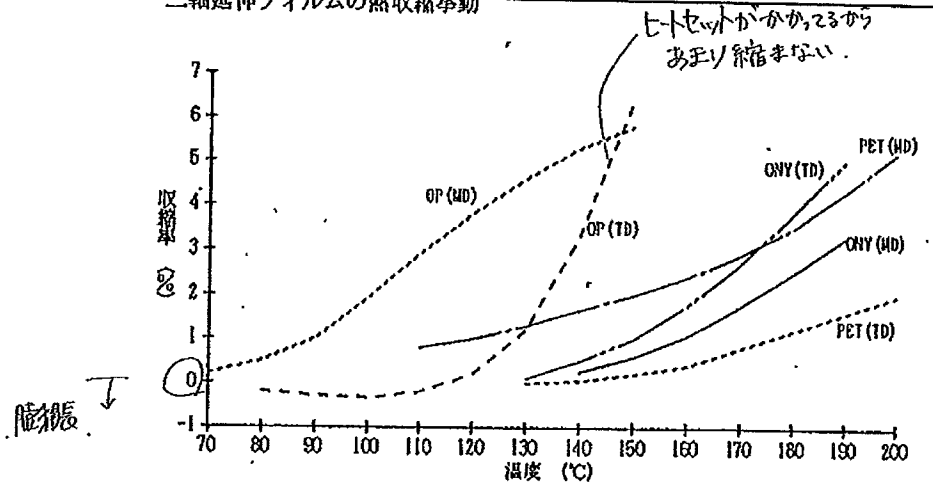
B

プラスチックは温度が上がれば膨張するが、更に温度が上がれば延伸フィルムは収

(B)

縮をする。これは延伸することにより、分子は延伸方向に配列され、その配列された状態を固定させるために熱セットされている。この熱セットで施された温度条件より高い温度がかけられると、セット状態がくずれて、延伸によって内蔵されていた歪みを取りのぞく動きとして収縮が起こる。無延伸フィルムはこのような収縮挙動はない。

二軸延伸フィルムの熱収縮挙動



測定条件；乾熱 OPP(10分), PET(30分), ONY(10分)
オーブンにフリーで入れて測定。

各種フィルムの熱収縮率

フィルム	厚み(μm)	収縮率(%) MD	収縮率(%) TD	測定条件
CPP	40	0.4~1.7	0.2~1.0	120℃, 30分
LLDPE	50	1.0~1.5	0~0.3	90℃, 30分
OPP	20	3	0.5	120℃, 5分
PET	12	1.1~1.4	0~0.2	150℃, 30分
ONY	15	0.9~1.0	0.8~1.1	160℃, 10分
PVDC	15	6	2	90℃, 5分
EVOH	15	4	0.5	140℃, 1h

→高温にたえれる。

二軸延伸フィルムは融点近くにならないと縮まない。

4. 表面特性

(1) 光学特性

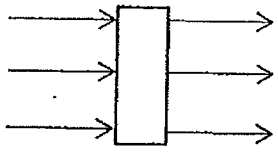
フィルムの外観特性である透明性、光沢やマット調について説明する。

①透明性（ヘイズ）（JIS K7105）

→何%が横ににげたか。
ヘイズ値大きいほど不透明。

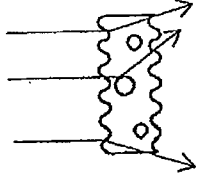
透明性の良いフィルムは入射光線がフィルムの外部及び内部で散乱されずに透過することである。フィルムの表面が粗かったり、フィルム内部に無機物や大きな結晶などがあると透明性は悪くなる。

透明性の良いフィルム



EVOH

透明性の悪いフィルム



レトルト用CPP

発行所
（株）東洋紡パッケージング・プラン・サービス
(TOYOBO PPS INC.)
発行者
中山　登

□ヘッドオフィス
大阪市北区堂島浜2丁目1番13号
東洋紡浜ビル　3F　　〒530
Tel:06-348-1363
Fax:06-348-1875

□東京オフィス
東京都中央区日本橋小網町17-9
東洋紡ビル　4F　　〒103
Tel:03-3660-4897
Fax:03-3660-4871

ISBN4-925088-01-7 C2058 ¥25000E
1997.3.30 発行

Partial translation of Attached material 2

Introduction to Packaging Film

(A)
To suppress the heat-shrinkability of the film after the drawing, the heat-set is done.
(page 50, line 4)

(B)
Although plastic expands when the temperature rises, if the temperature further rises, the drawn film shrinks. This mechanism of shrinkage is as follows. The molecule is arranged in the direction of the drawing and heat-set acts to fix the arranged state. When a temperature that is higher than the temperature condition by this heat condition is applied, the arranged state collapses, and shrinkage happens as a movement to remove the distortion caused by the drawing. Such a shrinkage behavior is not seen in a no drawing film.
(page 66, last line to page 67, line 5)

Publishing Office: TOYOBO PACKAGING PLANNING SERVICES, INC. (TOYOBO PPS INC.)

Publisher: Noboru Nakayama

□Head Office
Toyobo Hama BLDG, 3F
2-1-13 Dozimahama, Kita-ku
Osaka-Shi, Osaka
530 JAPAN
Tel: 06-348-1368
Fax: 06-348-1875

□Tokyo Office
Toyobo BLDG, 4F
17-9 Koamityo, Nihonbashi,, Chuou-ku
Tokyo
103 JAPAN
Tel: 03-3660-4897
Fax: 03-3660-4871

ISBN4-925088-01-7 C2058 ¥25000E
Published on March 30, 1997